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SOUTHWEST FISHERIES CENTER

MONTHLY REPORT - DECEMBER 1984

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SOUTHWEST FISHERIES CENTER

MONTHLY REPORT - DECEMBER 1984

STATUS OF PUBLICATIONS

Published

Boehlert, G.W., and M.M. Yoklavich. 1984. Reproduction, embryonic energetics, and the maternal-fetal relationship in the viviparous genus Sebastes (Pisces: Scorpaenidae). Biological Bulletin (Woods Hole) 167:354-370.

Reproduction in the scorpaenid genus Sebastes has been characterized as primitive ovoviviparity. In the black rockfish, S. melanops, egg size is small (0.8 mm), but the gestation period is 37 days and larvae at birth are well developed, with a remnant of yolk and the ability to initiate feeding. To test the hypothesis that this species is viviparous with additional maternal nutrition, we studied embryonic energetics and morphology. Catabolism during development utilized 64% of the yolk energy, resulting in a maximum yolk utilization efficiency of 36%, similar to oviparous fishes. Calorimetry, however, demonstrates that 81% of the initial yolk energy is present at birth. Thus approximately 70% of the catabolic energy is contributed by the maternal system during gestation. Microscopic analysis of embryonic epidermis suggests no specializations for nutrient uptake. Histological observations, however, reveal that the hindgut is functional approximately 22-25 days after fertilization. Thus, we suggest that nutrition occurs through consumption and assimilation of ovarian fluid.

Reproductive modes in the Scorpaenidae have apparently evolved from simple oviparity in seven of eight subfamilies, to lecithotrophic viviparity in more primitive members of the subfamily Sebastinae, through matrotrophic viviparity in Sebastes. This pattern involved progressively longer retention of embryos until after organogenesis and functional differentiation of the gut, facilitating this rather primitive form of embryonic nutrition among matrotrophic viviparous species.

Boehlert, G.W., and M.M. Yoklavich. 1984. Variability in age estimates in Sebastes as a function of methodology, different readers, and different laboratories. Calif. Fish Game 70:210-224.

THIS REPORT DOES NOT CONSTITUTE PUBLICATION AND IS FOR INFORMATION ONLY

Age was determined in the fast growing canary rockfish, Sebastes pinniger, and the slow growing splitnose rockfish, S. diploproa by different laboratories, techniques, and readers. Variability between agencies depended upon method and species. For S. pinniger aged by both laboratories, whole otolith ages were similar, whereas the otolith section ages greatly exceeded those of whole otolith ages. Clear differences were noted for the slower growing S. diploproa; whole otolith ageing methods differed between the two laboratories, with much greater ages for larger specimens assigned by one laboratory. These older whole otolith ages showed similarities to the longevity noted with sections. We suggest two areas where improvement in precision of age determination is necessary. First, a consensus on ageing methodology (whole versus sectioned or broken and burned otoliths) is necessary to allow meaningful comparisons between readers. Secondly, mechanisms to allow comparisons between agencies or laboratories are necessary to provide ages which are at the least, consistent, for use by fisheries managers.

King, M.G. and R.B. Moffitt. 1984. The sexuality of tropical deepwater shrimps (Decapoda: Pandalidae). J. Crustacean Biol. 4:567-571.

Morphometric studies were carried out as part of resource assessment surveys on deepwater pandalid shrimps in both the northern and southern tropical Pacific Ocean.

Previous works have suggested that pandalid shrimps, including those of some tropical species, are typically protandrous hermaphrodites. In this study, however, measurements of certain male secondary sexual characteristics were positively correlated with shrimp size. There was no evidence of degeneration of these characteristics in larger individuals as would be expected with protandrous hermaphropdites. We conclude that shrimps of the tropical pandalid species examined are dioecious and that sex reversal does not occur.

Stone, H.S. 1984. Hawaiian monk seal population research, Lisianski Island, 1982. U.S. Dep. Commer., NOAA Tech. Memo. NMFS, NOAA-TM-NMFS-SWFC-47, 33 p.

The absolute number of animals in the Hawaiian monk seal, Monachus schauinslandi, population at Lisianski Island was determined by identifying individuals on the basis of applied bleach symbols and natural marks, and conducting 98 island censuses from 17 March to 14 September, and 26 October to 22 November 1982. The extensive data base obtained by these marking and census methods should provide specific quantitative information that may be useful in the interpretation of future census and population data from islands used by Hawaiian monk seals. The alternate day censuses provided data on temporal and spatial haul-out patterns for individual seals. Data were collected daily on pupping, weaning, molting, and other factors that may influence haul-out patterns. Injuries and deaths were documented.

In addition to 28 pups of the year, 215 seals consisting of the following were identified: 18 male and 10 female juveniles, 24 male

and 21 female subadults, and 101 male and 41 female adults. Only two of these seals (an adult female and adult male) were known to have moved to Lisianski Island from other islands during the study. Three pups died, and a subadult female disappeared and is presumed dead. There were three serious injuries: two adult females with dorsal wounds, and a shark-injured adult male.

Whipple, Jeannette A., Marvin Jung, R. Bruce MacFarlane, and Rahel Fischer. 1984. Histopathological manual for monitoring health of striped bass in relation to pollutant burdens. U.S. Dep. Commer., NOAA Tech. Memo. NMFS, NOAA-TM-NMFS-SWFC-46.

Approved by Center Director

Holts, Dave. Recreational albacore fishery by west coast commercial passenger fishing vessels. For consideration for publication in Marine Fisheries Review.

Perry, S.F., C. Daxboeck, B. Emmett, P.W. Hochachka, and R.W. Brill. Effects of exhausting exercise on acid-base regulation in skipjack tuna (Katsuwonus pelamis) blood. Physiological Zoology.

_____. Effects of temperature change on acid-base regulation in skipjack tuna (Katsuwonus pelamis) blood. Comparative Biochemistry and Physiology.

Ralston, Stephen. Length-weight regressions and condition indices of lutjanids and other deep slope fishes from the Mariana Archipelago. Micronesica.

Squire, James L., Jr. Relationship of sea surface temperature isotherm patterns off northwestern Mexico relative to the catch of striped marlin Tetrapturus audax, off southern California. For consideration for publication in Marine Fisheries Review.

Squires, Dale. Production technology and public regulations in the New England sea scallop industry. For consideration for publication in Land Economics.

HONOLULU LABORATORY
Honolulu, Hawaii

PELAGIC RESOURCES INVESTIGATION

Attempts to Catch Yellowfin Tuna for Tracking Unsuccessful

Researchers of the Tuna Behavior and Physiology Task spent ten days fishing aboard the R/V Kaahele'ale to catch and tag yellowfin tuna, Thunnus albacares, with ultrasonic transmitters. The objectives of this project are to determine the residence time, depth distribution, and short-term movement of yellowfin tuna around fish aggregating devices.

Two mahimahi, Coryphaena hippurus, and numerous very small (<30 cm fork length) yellowfin tuna were landed; however, no yellowfin tuna of the appropriate size (>60 cm fork length) were caught. Attempts to catch and track yellowfin tuna are scheduled to resume in mid-January.

Filming Completed at Kewalo Research Facility

Paul Atkins of Moana Productions and Mike deGruy of the film crew have completed filming tuna swimming and feeding behavior and some standard operations involving tunas at the Kewalo Research Facility. This film footage will become part of a British Broadcasting Company natural history series.

Experiments on Acid-Base Regulation of Tunas Continue

As part of the research to determine the effect of low ambient oxygen conditions on the distribution and gear vulnerability of tunas, Dr. Richard Brill, Leader, Tuna Behavior and Physiology Task, has begun a series of experiments to examine the mechanisms tunas employ to control the blood acid-base balance (i.e., blood pH) in response to temperature change, strenuous exercise, acute blood pressure disturbances, etc. Several combinations of water soluble and injectable anesthetic combinations have been employed to obtain fish with stable blood pH following the surgery required to implant the dorsal and ventral aorta catheters used for repeated blood sampling. No fish have yet displayed stable blood pH following surgery.

COASTAL FISHERIES RESOURCES DIVISION
La Jolla, California

COASTAL EASTERN PACIFIC POPULATION BIOLOGY OF FISHES

Preliminary Analysis Completed of Stomach Contents of Chub Mackerel

This month, biological technician Eric Lynn and fishery biologist John Hunter completed their preliminary analysis of the stomach contents of chub mackerel (Scomber japonicus) which were taken in the fishery. The objective of this research is to determine the fraction of the anchovy population consumed by the chub mackerel population in the California Current Region. In order to carry out the objectives of this research, Lynn and Hunter measured the digestion rate of mackerel in the laboratory; the stomachs of 1,268 field-caught mackerel were examined. These fish were collected over a 17-month period by California Department of Fish and Game scientists during routine port sampling activities.

The weight of the average stomach contents varied only slightly during the season. It was lowest in the fall quarter and averaged about 2.1% of body weight over the entire year. The daily ration for chub mackerel was estimated to be about 3% of their body weight per day (gastric evacuation coefficient = 0.06). The fraction of the food consumed by mackerel identified as anchovy and separately weighed was about 20%, indicating that the mackerel population may consume anchovy at the rate of 0.6% of their body weight per day.

Euphausiids were the other major element of the diet that could be separated from the gut contents and weighed separately. These made up about 4.5% of the diet by weight. The majority of the stomach contents contained highly digested remains that could not be separately weighed.

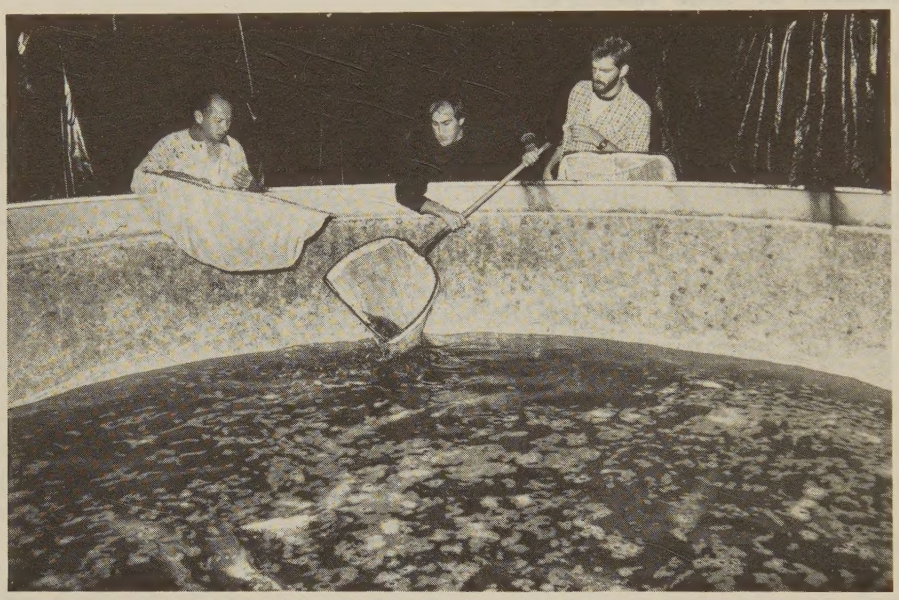
If the mackerel population is about 100,000 tons, these preliminary calculations indicate that the population may consume about 600 tons of anchovy per day, or about 219,000 per year. These preliminary calculations undoubtedly overestimate the amount of anchovy consumed by the mackerel population. The fishery (and therefore the samples examined) contain a disproportionate number of older and larger mackerel. Such fish are probably more piscivorous than the smaller fish. Nevertheless, these calculations indicate that mackerel predation on the adult anchovy population may have important consequences.

White Seabass Transferred to Hubbs-Sea World

On December 16, 1984, fishery biologist Roderick Leong and staff from the Hubbs-Sea World Research Institute transferred 16 white seabass, long-time residents at the Center, to laboratories at Sea World. These seabass were undersized and immature fish, captured by live bait fishermen, when they were brought to the Center in 1980 for early life history studies.

At the Center, Leong developed techniques for induction of spawning; the fish first spawned successfully in 1982 and every year thereafter.

Researchers at Hubbs-Sea World will use the bass for studies on raising fish in captivity for release into the wild. This research will be funded by Assembly Bill 1414, which provided for the establishment of an Ocean Resources Enhancement Program. This program was established to encourage research on the rearing and stocking of marine fishes, specifically white seabass and California halibut.



Roderick Leong (left) and staff from Hubbs-Sea World net the anesthetized white seabass.

Work Continues on Computer Model of Larval Fish Growth and Mortality

Fishery biologist John Butler is working on a computer model of larval fish growth and mortality. The model tests the assumption of sampling bias due to mortality and duration at stage. If the production of larvae is constant, the model predicts the average age of larvae in 1 mm size interval from 5 mm to 20 mm. If a mean growth rate with normal variance is assumed, the population of fish larvae at each size is calculated under exponential mortality. Increasing the instantaneous mortality rate or increasing the variance in growth rate biases the population toward faster growing larvae.

* * * * * * * * * *

Butler has also completed a manuscript on the growth of sardine larvae off Peru. The manuscript is based on the work that Butler and marine biologist Blanca Rojas de Mendiola of Peru completed this summer and reported at the 1984 CalCOFI meeting. The manuscript, entitled "Growth of

larval sardines off Peru" by Butler and de Mendiola, will be submitted to CalCOFI Reports.

COASTAL EASTERN PACIFIC FISHERIES ENVIRONMENTAL INVESTIGATIONS

Center Oceanographer Presents Paper on El Niño and Northern Anchovy

Dr. Paul Fiedler attended a meeting of the American Geophysical Union and the American Society of Limnology and Oceanography in San Francisco, December 3-7, along with over 2,000 oceanographers, and atmospheric and earth scientists. Fiedler, perhaps the only fisheries scientist attending, presented a paper entitled, "Effects of the California El Niño on the Northern Anchovy" in a session on the effects of El Niño.

In his paper, Fiedler concluded that: 1) El Niño caused physical and biological changes in the habitat of the central stock from late 1982 into 1984; 2) a high proportion of small, young spawners from the large 1982 year class caused a low specific fecundity in 1983; 3) spawning range expanded in 1983 due to shifts in sea surface temperature boundaries; 4) slow growth of juveniles and adults during El Niño resulted in abnormally small spawning females in 1984; 5) spawning effort was relatively high in 1984, perhaps as a compensatory response to minimize the effects of El Niño; 6) larval mortality was high in 1983, which contributed to low recruitment in 1984; 7) El Niño did not markedly accelerate the continuing decline in stock size that began in 1975. These results, which are based on data contributed by many staff scientists at the Southwest Fisheries Center, Scripps Institution of Oceanography, and California Fish and Game, are being compiled into a manuscript for publication.

Commercial and Recreational Fisheries Research for Management Center Economists Continue Involvement in Diverse Studies

From December 10 to 12, Drs. Dan Huppert and Dale Squires met with other NMFS economists in Tiburon to coordinate plans for the limited access study. Participating in the meeting were Wes Silverthorne and Chuck Korson, Southwest Region, Ed Ueber, Tiburon Laboratory, Susan Hanna, Oregon State University, and Joe Terry and Richard Marasco, Northwest and Alaska Fisheries Center. As a result of the meeting, Huppert, Silverthorne, Squires, Ueber and Hanna will be active on the Working Group, and Marasco and Terry will assist in the research when necessary.

A study of trawl vessel costs is being conducted by the Southwest Region and the Southwest Fisheries Center. The study has two components: 1) Silverthorne, Korson, and Squires are specifying and estimating econometric models of trawl harvesting costs as part of a budget simulator to support management and financial analyses of the fleet; 2) Squires is examining input demand, substitution among species, and marginal costs of harvesting. Completion of these studies is contingent upon gaining access to existing NMFS data held by the Capital Construction Fund program in Washington, DC.

Staff members are experimenting with a linear programming model to determine the minimum number of vessels needed to catch the harvest guidelines and quotas of groundfish species. R. Marasco and Grant Thompson, Northwest Center, agreed to develop the analytical model based upon data from the PACFIN data base. By trying alternative versions of the linear programming approach they will gain a better understanding of the ultimate fleet capacity needed to catch Pacific groundfish, and comparison of the results of this analysis with those of Squires' more sophisticated cost model will provide some form of verification.

Squires continued to work on papers involving analysis of cost and harvesting production functions for New England scallop and groundfish trawlers. He completed a paper reporting on his estimate of a profit function for scallop vessels and submitted it to Land Economics. Work on the groundfish trawl fishery involved estimating multiproduct profit functions.

Economist Cynthia Thomson worked on two reports this month. "Time as a Source of Joint Production in Recreation Demand Models" describes conditions under which time can be a source of joint production when recreation demand is modeled in a household production framework. It also shows how an estimate of the long-run shadow price of time, which is generally unobserved and subject to ad hoc treatment in the literature, can sometimes be obtained from the household's restricted cost function.

Thomson also worked on a research proposal pertaining to the upcoming San Francisco Bay Area survey of recreational anglers. The proposed model describes angler behavior as a two-stage decision process. Total fishing expenditures will be determined in the first stage and allocation of expenditures to different fishing alternatives will be determined in the second stage. The second stage will be modeled in a utility theoretic framework, with fishing alternatives defined in terms of mode, area fished and season. Angler behavior will be represented by a system of share equations, and each equation will correspond to a different alternative. Because individual anglers are not expected to participate in all available alternatives, the shares are assumed to follow a truncated multivariate normal distribution. Details of the equations are currently being worked out, including the choice of flexible functional form and appropriate methods of incorporating catch rates and angler characteristics into the equations.

Fishery Biologist Discusses Recovery of Brown Pelicans

Fishery biologist Alec MacCall attended a workshop sponsored by the U.S. Fish and Wildlife Service (USFWS) on the status of the California brown pelican. The meeting was held in Long Beach on December 13, 1984. The brown pelican was originally classified as an endangered species due to reproductive failure associated with DDT contamination. The threat of DDT has been largely eliminated due to its ban in the U.S. and effective control of manufacturing effluents. This improvement has allowed the Fish and Wildlife Service to consider reclassifying the pelican to threatened status or taking it off the endangered species list altogether.

Under the Endangered Species Act, the environment of these species, which includes their forage supplies, must be considered. The northern anchovy is the principal food item in diets of brown pelicans in southern California, although these birds consume sardines in the Gulf of California where sardines are still abundant. The northern anchovy Fishery Management Plan, developed at the SWFC, included estimates of fishery impacts on pelicans, and demonstrated a high correlation between pelican reproductive success and anchovy abundance.

The recent trend toward a decrease in U.S. anchovy fishery activity is not expected to change, and suggests that pelican forage will not be affected by U.S. fisheries in the foreseeable future. The continuing Mexican fishery for anchovies, however, can be expected to have an influence, although that fishery is far to the south of the California pelican colonies. On the other hand, it is reasonable to assume that the normal diet of pelicans in California would include sardines, as is the case in the Gulf of California. The continuing absence of sardines in California waters therefore constitutes an unnatural single-species forage base, which leaves the pelicans susceptible to the severe natural fluctuations of the anchovy population. The environment of the California brown pelican cannot be considered to be normal until the sardine resource recovers.

Statistical Method of Predator-Prey Evaluation Applied

Statistician Andy Bindman has been working on a method for estimating food preference parameters and prey abundances from the stomach contents of fish. The work was part of Bindman's Masters Degree which he recently obtained from the University of Washington. While working at the SWFC he has made further refinements to the analysis and is preparing a manuscript for publication.

The method, developed by Knud Andersen and Erik Ursin of Denmark, views fish as biased samplers of their prey. Once the bias is determined, vital information can be estimated, such as relative year-class strength of the prey, and the predator's size selective feeding parameters.

Andy Bindman has applied the method to data on the stomach contents of Pacific cod (Gadus macrocephalus) caught in the Bering Sea in the summer of 1981. This work is the first application of this method to any species besides the Atlantic cod.

OCEANIC FISHERIES RESOURCES DIVISION
La Jolla, California

TUNA ASSESSMENT INVESTIGATIONS

Guidelines Completed for Reducing Dolphin Kills During Tuna Purse Seining

More than a decade has passed since the passage of the Marine Mammal Protection Act of 1972. During that time the United States tuna purse seine fleet reduced its incidental porpoise mortality rate by more than ten-fold. This was made possible, in part, through the efforts of the Marine Mammal Technology Program (MMTP) at the Southwest Fisheries Center. The staff of the MMTP developed gear and techniques that helped to reduce the frequency of events that contributed to the kill. The major results of that program have now been published as a NOAA Technical Report, NOAA-NMFS-SWFC-13 entitled, "Guidelines for Reducing Porpoise Mortality in Tuna Purse Seining" by James Coe, David Holts, Fishery Biologists, NMFS, and Richard Butler, presently of Gourmet Prawns, Inc., Reno, Nevada.

The guidelines describe the most effective methods available for preventing dolphin mortality during tuna purse seining operations. The authors show the success of the U.S. fleets in reducing mortality from 170,000 dolphins in 1970 to less than 20,000 in 1981. During this period the number of sets in which zero dolphins were killed increased from 12% to nearly 70% and skilled operators, using the techniques described in the guidelines, were able to release more than 99.9% of all the dolphins they captured. The immediate goal of the staff of the MMTP was to identify the obvious and most serious mortality-related problems and institute corrective measures. At the same time they began work on a long-term goal aimed at understanding the dynamics of the vessel, deck gear, and purse seine and how they interacted with dolphin behavior. Several methods were used to bring all pertinent information, and techniques to the fishing community on a timely basis.

In the guidelines the authors discuss the primary reason dolphins are killed--suffocation after being entangled or entrapped in folds and canopies of the net (Table 1). The configuration of the net, both before

Table 1. Numbers of porpoise killed by general cause in sets with greater than 15 porpoise killed; NMFS observed trips, 1977-1980.

Year	Number of sets (%)	Total kill (%)	Backdown Canopies Bow	Stern	Other	Total	Pre B.D. net collapse	B.D. channel collapse	Malfunction mortalities	All other causes	Unknown
1977	135 (4.0)	5,277(51.6%)	749	1,539	774	3,062	440	346	329	339	780
1978	73 (4.6)	4,932(68 0%)	478	486	872	1,836	1,897	338	397	243	221
1979	54 (3.5)	2,879(47.1%)	960	173	43	1,176	284	326	84	925	84
1980	30 (2.9)	2,647(65.7%)	106	206	220	532	29	1,504	303	140	139
Total	292 (3.9)	15,735(67.0%)	2,293	2,404	1,909	6,606	2,650	2,514	1,113	1,647	1,224
Percent of total kill		100%	15	15	12	42	17	16	7	10	8

and during the backdown release procedure was a major determinant of the number of porpoise killed. Environmental conditions and mechanical failures of net configuration can cause high dolphin mortality unless mitigated by skilled maneuvers by the fishing boat captain or by the use of speedboats to adjust the net. Speedboats used to chase dolphins could also be used to tow on the corkline and prevent net collapse and also to adjust the net configuration to reduce canopies before backdown (Figure 1). Additional strips of webbing to deepen the net further reduced the probability of dolphins being killed by pre-backdown net collapse.

The backdown procedure remains the only means to release captured dolphins effectively from a purse seine. It is also the time during the set when most of the mortality occurs. The use of small mesh safety panels and aprons in the backdown areas of net reduces dolphin entanglement, and increases the probability of an effective release. The tie-down points of the net for preparing the backdown channel must be properly located in order to optimize dolphin release (Figure 2). A simple method to calculate the precise tie-down points was developed for the net regardless of its depth. Understanding the dynamics of the backdown procedure and the functional distribution of webbing during backdown (Figure 3) permitted development of a thorough guide for troubleshooting backdown performance, thus preventing the repetition of poorly executed backdowns and higher mortality rates.

Dolphins that are not released during backdown must be rescued by hand. A rescuer in an inflated raft can rescue dolphins any time during a net set. This was shown to be most useful during the later stages of backdown where rescuers were able to remove any dolphins that were reluctant or unable to leave the net. This significantly increased the number of zero kill sets. In all circumstances, the skill and motivation of the captain and his crew were the final determinants in the prevention of incidental dolphin mortality in tuna seining.

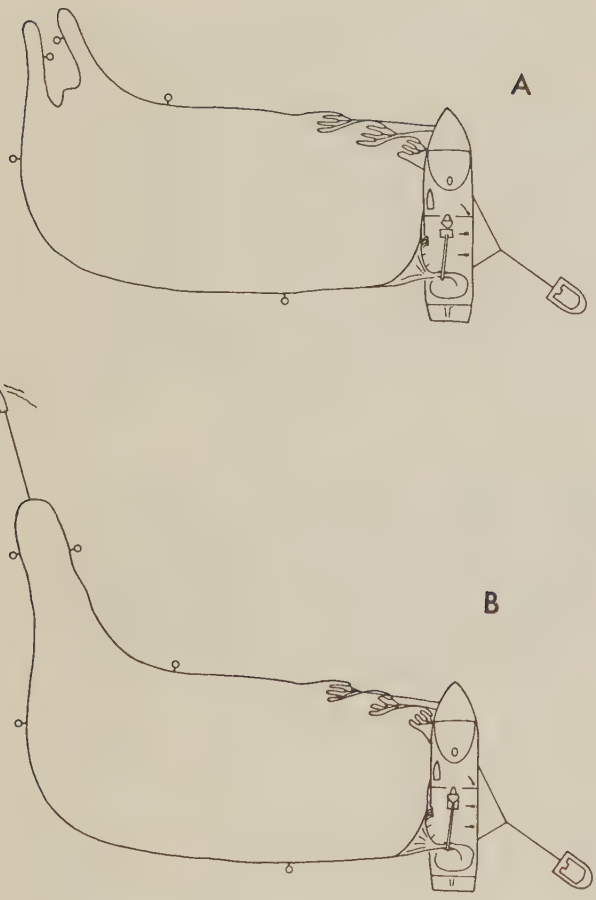


Figure 1. Use of a speedboat to pull out or straighten a collapsed section of net was found to be a simple way to eliminate potential problems.

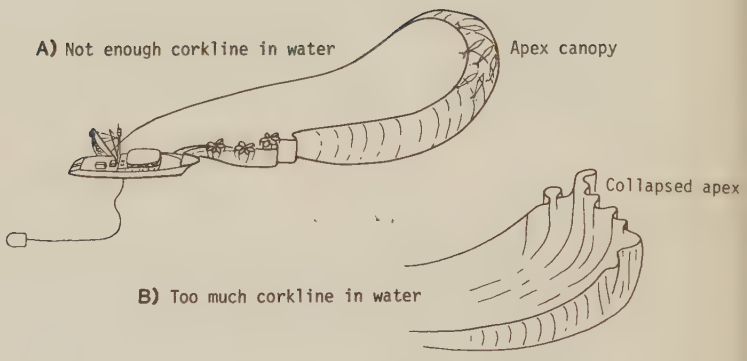


Figure 2. The proper amount of corkline in the water for backdown is directly related to the depth of the net. Too little corkline (a) results in apex canopies, too much corkline (b) produces a collapsed and wrinkled corkline. To ensure that the precise amount of corkline was in the water every set, the precise tie down point was calculated and clearly marked.

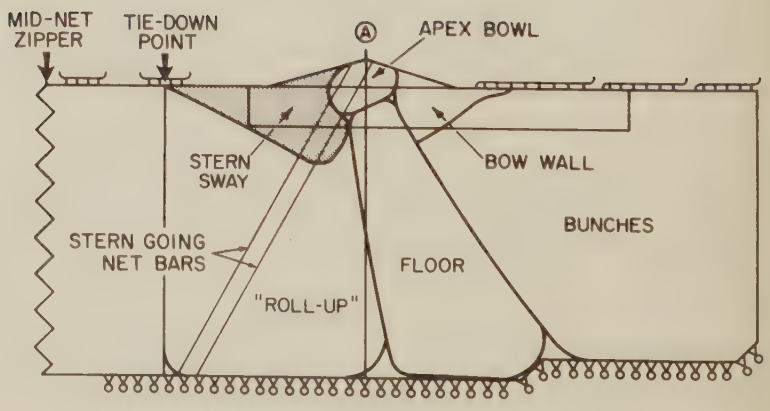


Figure 3. The functional distribution of webbing in a stabilized backdown channel, identified by divers, helped researchers to understand the dynamics of the purse seine during backdown.

MARINE MAMMAL ASSESSMENT INVESTIGATIONS

Model Completed to Estimate Mean Persistence Time

For many species of marine organisms, population longevity can be highly uncertain. This uncertainty is usually related either to environmental variability affecting a small, localized population or to external events, such as overfishing or ecological displacement by an exotic species. The purpose of the research described in this report was to develop a model that would use readily available data on population status and predict the expected number of years a population would persist. This work has been done by James Berkson, Oceanic Division, and Dr. Dan Goodman, Montana State University, under contract to the Southwest Fisheries Center; Dr. Douglas DeMaster, Oceanic Division, was the Contract Office Technical Representative for the contract.

The model is a modification of a birth-death process model, which is basically a continuous model that assumes that all births and deaths are independent and exponentially distributed. The birth and death rates are estimated from data on the rate of population change and its variance. The derivation for converting growth rates and its variance to birth and death rates was worked out by Goodman. The only data required to perform this analysis is a time series of population indices; the rates of birth and death are then used to estimate the mean persistence time.

The results of the analysis indicate that a population of 500 animals with an instantaneous growth rate of zero and a relatively high variance would persist, on average, 48 years. The same population with a positive growth rate of 5% per year would persist, on average, 72 years.

In general, the results indicate that as environmental variance increases, persistence time decreases. Also, as the growth rate increases, so does the mean persistence time. Finally, the range of persistence times between low variance and high variance populations increases as the growth rate increases.

Unfortunately, the distribution of persistence times does not follow a normal distribution and is not symmetric; therefore estimating confidence intervals at present is not possible. It is probably not acceptable to manage species based on average persistence time. Rather, some type of game theory, which depends on minimizing losses, should be incorporated into the management plan.

BIOLOGICAL SYSTEMS INVESTIGATIONS

Pilot Whales Surveyed

A survey for pilot whales in the Southern California Bight was conducted aboard the NOAA Ship, David Starr Jordan, from December 5 to 19, 1984. The survey was run along 11 track lines oriented in a northeast-southwest direction, approximately perpendicular to the coastline. Each track line started 10 miles off the coast and continued up to 100 miles offshore, or at least to the edge of the Tanner Basin, and each required about 1 day to survey. The track lines were spaced 15 miles apart. The six scientists who participated on this survey were Aleta Hohn, Chief Scientist, Jay Barlow, Susan Chivers and Stephanie Sexton of SWFC, Michael Scott, Inter-American Tropical Tuna Commission, and Omar Vidal, Escuela de Ciencias Maritimas, Instituto Technologico de Monterrey, Guaymas, Mexico.

Although the primary purpose of the survey was to determine the distribution and abundance of pilot whales, all cetacean sightings were recorded. There were 127 sightings of schools of cetaceans; sightings were distributed as follows:

Species	Number of Sightings
Common dolphin	48
Risso's dolphin	14
Fin whale	12
Pacific white-sided dolphin	11
Dall's porpoise	3
Bottlenose dolphin	1
Right-whale dolphin	1
False killer whale	1
Humpback whale	1
Minke whale	1
Pilot whale	1
Bottlenose dolphin/Risso's dolphins mixed-species school	3
Common dolphin/dall's porpoise mixed-species school	1
Common dolphin/Risso's dolphin/ Pacific white-sided dolphin mixed-species school	1
Unidentified dolphin	11
Unidentified whale	15
Unidentified cetacean	3

Only one school of pilot whales with 10-11 individuals and one very small calf was sighted. This school was seen near the northwest end of San Clemente Island. No pilot whales were sighted near Santa Catalina Island. Before 1983, the whales aggregated in large numbers (up to 1,000 animals)

around this island to feed on squid that concentrate on the spawning grounds. Very few squid have been reported around Santa Catalina Island this year to date, and very few were present during the winter of 1984, when only a small school of pilot whales was also seen near Santa Catalina. This school did not arrive until January or February, well past the expected arrival date in December. Hohn speculates that the pilot whales have not followed their pattern of previous years (pre-1983) because of the presence of warmer-than-normal waters caused by the El Niño, the same factor that has probably kept the squid away in the Southern California Bight.

A similar survey was conducted in April 1982, and in December 1983 a pilot whale survey aboard the Jordan concentrated on areas of high density of pilot whales rather than surveying a large area of the Bight.

ECOLOGICAL FISHERY SYSTEMS INVESTIGATIONS

Food Habits Workshop Held at Pacific Grove

The Southwest Fisheries Center was well represented at GUTSHOP '84, the fourth workshop on fish food habits held December 2-6 at the Asilomar Conference Center in Pacific Grove, California. Hannah Bernard, Eric Lynn, Gail Theilacker, Chris Boggs and Patti Schmitt attended.

The workshop covered five major topics: methodology and statistics, physiology of feeding and digestion, foraging behavior (including an open microphone session), competition and resource partitioning, predation effects on prey behavior and ecology. GUTSHOP has grown from a small, rather informal gathering, to a large, international group of researchers who have gathered, as described in the workshop syllabus, for "...an opportunity for presentation and discussion of contemporary field and experimental approaches to fish food habits studies and of the application of the results to understanding physiological, behavioral, and ecological dynamics of fish foraging." All five of the sessions were characterized by stimulating and thought-provoking papers addressing the issues.

As in previous workshops, all of the sessions were tape-recorded for later synthesis and incorporation into a workshop proceedings (to be published in hardcover). Selected papers presented at the workshop are being planned for publication in the journal Environmental Biology of Fishes.

PACIFIC ENVIRONMENTAL GROUP
Monterey, California

Anomalous Ocean Warming Events in Certain Boundary Current Systems Described

Diagnostic studies of major marine environmental anomalies that have important effects on fish populations are one of the primary focuses of scientific activity at PEG. Such studies provide the background of understanding required for effective environmental support of various fisheries research programs at the SWFC and other NMFS laboratories. Recently, Dr. Douglas McLain and co-workers have described anomalous ocean-warming events in eastern boundary current systems. These current systems (off California and Peru-Chile in the Pacific and off Morocco to Senegal and Angola to South Africa in the Atlantic) all have persistent upwelling of nutrient-rich waters and all support large populations of similar species of pelagic fish. Anomalous warm and cold periods have been noted in each of the areas, most notably the El Niño warm events in the Pacific.

Sea surface temperature observations are sufficiently abundant in all four areas to develop climatological mean values and determine monthly anomalies for the last few decades. Subsurface observations down to 400 m are sufficiently abundant off California to develop similar means of subsurface temperature fluctuations, although subsurface data are only marginally abundant off South America and northwest Africa and very sparse off southwest Africa.

The results of calculating means and determining anomalies from available observations show that during El Niño conditions in the Pacific, the thermal structure of the water column is depressed by over 100 m and warmed by several degrees Celsius. These conditions are associated with strong poleward coastal currents from the tropics and greatly reduced upwelling of nutrients to the surface waters. Interyear variability of conditions is high off South America and moderate off California.

In the Atlantic the interyear variability is less intense than in the Pacific, but significant fluctuations do occur. It is not yet known how anomalous conditions in Atlantic eastern boundary currents may be linked with similar events in the Pacific by atmospheric circulation changes, although anomalous conditions in the Atlantic occur about a year after similar anomalous conditions in the Pacific. This lag effect is being investigated.

An example of such a lag effect was a strong anomalous warming (up to 5°C positive SST anomaly) which occurred in March to June 1984 off Namibia and South Africa and a month or so later off Angola. This warming, apparently an intrusion of warm water from offshore, occurred over a year after the large warming event in the Pacific in the winter of 1982-83. Indices of upwelling-favorable winds were computed for the area from FNOC pressure fields and showed that upwelling-favorable winds were stronger than normal during the event. Only a strong intrusion of warm water from

tropical offshore areas could override the effect of local upwelling to cause an anomalous warming of coastal waters off southwest Africa.

TIBURON LABORATORY
Tiburon, California

PHYSIOLOGICAL ECOLOGY INVESTIGATION

Monitoring of Striped Bass Continued by California Department of Fish and Game

As a result of previous work done by the Tiburon Laboratory, the California Department of Fish and Game (CDF&G) has been funded by the State Water Resources Control Board (SWRCB) to continue yearly monitoring of the condition and health of striped bass during the spawning season. Data analysis of prespawning striped bass collected in the 1984 monitoring effort and a report for review have been completed by Roger Johnson of CDF&G. Dr. Jeannette Whipple, Leader of the Physiological Ecology Investigation, prepared an outline of statistical procedures to be used in data analysis of the annual samples; the outline was submitted to the SWRCB Aquatic Habitat Committee and to CDF&G.

Whipple also analyzed slides of striped bass eggs for presence of abnormalities and resorption. A complete photographic record of eggs in different maturation stages and from both normal and abnormal conditions was completed for eggs collected yearly from 1978 to 1984. This information will be used to assess egg condition and will be included in a manuscript on striped bass reproduction. The condition of the 1984 striped bass appears to be better than in previous years, and residues of many pollutants were lower, although still present. Concentrations of monocyclic aromatic hydrocarbons were lower and less egg resorption of the type associated with these petrochemicals was present. As in previous years, however, DDT was detected in liver and ovarian tissue of a few females and was associated with abnormal egg development and poor egg condition, including yolk coagulation.

As a result, this research on the relationship of monocyclic aromatic petrochemicals with a low boiling point to poor egg condition and parasitization, the Regional Water Quality Control Board in Oakland, California, has required oil refineries to monitor effluents as recommended in the final report (Whipple, Jeannette. 1984. The impact of estuarine degradation and chronic pollution on populations of anadromous striped bass (Morone saxatilis) in the San Francisco Bay-Delta, California. A summary for managers and regulators. SWFC Admin. Rep. T-84-01).

* * * * * * * * * * *

Whipple reviewed a final report to the State Water Resources Control Board on the impact of chlorinated hydrocarbon residues on California striped bass, which was prepared by Dr. Donald G. Crosby et al at the Department of Environmental Toxicology, University of California, Davis.

* * * * * * * * * *

"Histopathological manual for monitoring health of striped bass in relation to pollutant burdens" has been published as a NOAA Technical Memorandum (NOAA-TM-NMFS-SWFC-46). Descriptions of the manual and the pollution monitoring program are given in a NOAA Technology Brief by the NOAA Office of Research and Technology Applications.

The final "Fourth progress report: Cooperative Striped Bass Study," by Marvin Jung, Dr. Jeannette Whipple, and Mike Moser, has been submitted to the State Water Resources Control Board.

FISH COMMUNITIES INVESTIGATIONS

Trophic Relationships among Fishes Influenced by El Niño

Many of the changes in marine communities that resulted from the recent El Niño can be attributed to altered trophic relationships. Analysis of data that had been collected before, during, and after El Niño documents changes in distribution and behavior among fishes that are related to the relative availability of specific prey.

This finding, based on studies at Santa Catalina Island by Dr. Edmund Hobson, Tony Chess, and Dan Howard, of the Predator-Prey Task, is illustrated by the trophic relationships of the senorita, Oxyjulis californica. Although planktivorous as a juvenile, this species shifts to a predominantly benthic diet when larger than about 100 mm SL. During the 9 years before El Niño (1972-1981), zooplankters made up less than 1% of the diet of larger senoritas at the Santa Catalina study site. Their prey during that time were almost entirely benthic organisms, in particular bryozoans (especially Membranipora membranacea and Thalamoporella californica, which encrust algae), ascidians (especially Trididemnum opacum), and amphipods (gammarids and caprellids). During the 1982-83 El Nino, there was a dramatic change in feeding behavior, as the larger senoritas consistently foraged high in the water column. Also, they were more frequently seen picking materials from the bodies of other fishes (cleaning). Six specimens collected during 1982--three of them as they swam close among benthic algae--had relatively few items in their guts, virtually all of them from the plankton, or from cleaning (i.e., fish scales, mucus, and parasitic crustaceans). No benthic organisms were present. The major item (over 70% of the diet) was planktonic crustaceans--copepods, euphausiid and caridean larvae--which have always been a major prey of juvenile senoritas, and only occasionally the major prey of adults.

The senorita abruptly changed its feeding behavior when the benthic organisms that had been taken previously sharply decreased in numbers in the environment during El Niño. Bryozoans were particularly depleted, especially Membranipora membranacea, a major prey that encrusts the giant kelp Macrocystis pyrifera. As reported earlier, the beds of giant kelp

that dominated the study area before 1982 were all but eliminated during El Niño. Other benthic organisms normally important as prey of the senorita, but in short supply at this time, included the ascidean Tridemnum opacum, which encrusts rock substrata.

There is little apparent evidence of recovery among organisms at the Santa Catalina Island site in 1984, the year after the El Niño. In fact, the condition of the giant kelp has been worse than in the previous two years. However, while the senorita continued its planktivorous habit earlier in the year, the benthivorous habit began to reassert itself later on. By midsummer, the species foraged less often in the water column, and 56% of the diet of six individuals sampled (125-175 mm SL) consisted of benthic organisms (48% bryozoans, 8% caprellid amphipids). Samples from the environment are still being analyzed, but preliminary results indicate increasing numbers of certain small benthic forms.

GROUNDFISH ANALYSIS INVESTIGATION

Rockfish Weights Estimated

Dr. William Lenarz, Leader of the Groundfish Analysis Investigation, and David Woodbury, Biological Aid, have been estimating length-weight relationships for rockfish, using a procedure developed by Lenarz that estimates length-weight parameters from aggregating data such as is often collected in fish landing sampling programs. While lengths of individual fish are measured, only combined weights are obtained for all fish of a given species collected in a sample. Lenarz and Woodbury are using data collected by the cooperative NMFS-California Department of Fish and Game rockfish sampling program that began in 1977.

Preliminary results indicate that the weight of 400 mm chilipepper (Sebastes goodei), a planktivore, was about 10% lower in 1983, the year of El Niño, than in previous years. On the other hand, the weight of bocaccio (S. paucispinis) does not appear to be different in 1983 from weights of previous years. Lenarz will present results of the study at the Western Groundfish Conference in February 1985.

Young-of-the-Year Flatfish Identified

During the June 1981 juvenile rockfish cruise, members of the Rockfish Task ran bottom trawls during daylight. Some juvenile rockfish, mainly Sebastes saxicola and S. semicinctus, were caught, but most of the catch was young-of-the-year flatfishes. These samples are now being identified. Citharichthys sordidus was the most abundant species; Microstomus pacificus and C. stigmaeus were also abundant. Also found were Glyptocephalus zachirus, Lyopsetta exilis, and Psettichthys melanostictus. Some samples are being sent out for verification.

FISHERIES INFORMATION SYSTEMS & ADP

Information Update on Molecular Super-Micro Computer

According to Fred Kellenberger, Data Systems Manager for the Southwest Fisheries Center, the La Jolla Laboratory's Molecular 32X computer, which had a history of malfunctions, is now operating satisfactorily. The faulty application processors, which may have been the cause of the bus lock problems, have been returned to the vendor.

Other ADP Activities in Brief

John Carr, Ben Remington, Fred Kellenberger, Rob Bistodeau, and Dorothy Roll met this month to work out the details of a start-up for the FY 1985 Financial Reporting System. They discussed how the system will work on the Molecular 32X and defined the meaning of on-line. The software and user documentation for the remote data entry of data will be available January 1, 1985. To cut costs, Honolulu and Tiburon users will first key their commitment data into their application processors and then transmit the file to La Jolla for incorporation into the Center's data base files.

Computer systems programmer Susan Iacometti continues to process PACFIN data. Presently, she is verifying the 1982 California data and will merge this file with the data from Washington and Oregon. She also correlated the vessel number with names and generated a report for review by Dr. Dan Huppert.

Iacometti and Roy Mendelssohn of PEG modified and tested KERMIT, a communication software program, for transmission of text files between the Monterey facility's Charles River computer system and the Center's La Jolla Standard Micro-Computer.

Backup System Added to WPACFIN Hardware

A Corvus Mirror system was installed, tested, and implemented on the central WPACFIN hard disk system at the Honolulu Laboratory it was reported by David Hamm, Computer Systems Analyst. This tape backup system allows fast and efficient backup of files on the Corvus hard disk system, which is connected to the Apple microcomputer and used by WPACFIN at Honolulu. Also, software upgrades were made to the Saipan Offshore Expansion System (SOES) in response to comments from the Division of Fish and Wildlife of the Commonwealth of the Northern Mariana Islands. These upgrades mark the end of the beta-test phase of SOES development. The first official release of the system (Version 1.0) was sent to the Division for implementation. A first draft of the User's Guide for the Saipan System was also developed.

MISCELLANEOUS

SEMINARS

La Jolla Laboratory

December 4 - Dr. Tim Smith, Southwest Fisheries Center, spoke on "100 Years of Cod Larvae."

10 - Mr. John W. Sherman III, Chief of Oceanic Services Branch, NESDIS/NOAA, gave a talk on "Future Oceanic Satellite Systems."

11 - Dr. Malcolm Jobling, University of Tromso, Tromso, Norway, spoke on "Fish energetics: Metabolism and growth interactions."

12 - Dr. Joe Hightower, University of Georgia, gave a seminar on "Harvest Policies for Multi-Age Fish Stocks."

18 - Dr. Craig Barrilotti, Marine Biologist at Kelco Corporation and Adjunct Professor of Marine Biology at San Diego State University, gave a talk on "Influence of Oceanographic Variables on Macrocystis Standing Crop before and during the 1982-1983 El Niño."

Tiburon Laboratory

December 6 - Fishery biologist Candis Cooperrider presented a talk to the research staff on sampling designs for groundfish studies.

13 - Dr. Joseph Hightower, Cooperative Fisheries Unit, University of Georgia, Athens, spoke on "Harvesting policies for multi-aged fish stocks." The Tiburon seminar series is a cooperative effort of the Paul F. Romberg Center for Environmental Studies (San Francisco State University) and the Tiburon Laboratory.

14 - Fishery economist Ed Ueber gave a presentation to the research staff on the Pacific Fisheries Management Council and groundfish economics.

HONORS AND AWARDS

La Jolla Laboratory

On December 18, 1984, Center Director Izadore Barrett presented awards to staff members at the Center. Norm Bartoo, Doug DeMaster, Andrew Dizon, Rennie Holt, Wes Parks, William Perrin, and Tim Smith received Special Act Awards. Dan Huppert, Michael Laurs, and Geoffrey Moser received Sustained Superior Performance Awards.

Rennie Holt receives award from Director Barrett.

Pacific Environmental Group

On December 17, 1984, Susie Myers, Stay-in School Employee at PEG, was presented with a Special Service Award.

VISITORS

Honolulu Laboratory

December 11 - Phillip Meyer of Meyer Resources, Inc., met with Dr. George Boehlert to discuss approaches to habitat research.

20 - Dr. John Byrne, former NOAA Administrator and currently President, Oregon State University, made a courtesy visit to the Laboratory and talked with Dr. Jeffrey J. Polovina and Mary Lynne Godfrey.

La Jolla Laboratory

December 18 - Seven Chinese scientists and engineers led by Zheng Guobiao, Bureau of Aquatic Products, Ministry of Agriculture, Animal Husbandry and Fisheries, visited the Center. The purpose of the scientists' visit to the U.S. was to discuss artificial reefs.

Pacific Environmental Group

December 11 - Drs. Jon Roughgarten, Steve Brown, Steve Gaines and Charles Baxter of Hopkins Marine Station of Stanford University discussed flow patterns in California coastal waters and within Monterey Bay with Bakun, Norton, Husby, Sund and Parrish.

12 - D.B. Rao and Allen W. Fritz of the National Meteorological Center, Washington, DC, visited with Doug McLain and discussed NMC-Fleet Numerical Oceanographic Center.

13 - Mickey Eldridge, Bruce McFarland, Mike Bowers and Pete Benville of the Tiburon Laboratory visited PEG. They discussed environmental aspects of the new groundfish research project.

Tiburon Laboratory

December 10-12 - Susan Hanna, Oregon State University; Samuel Herrick, Daniel Huppert, and Dale Squires, SWFC, La Jolla; Charles Korson and Wesley Silverthorne, SWR, Terminal Island; Richard Marasco and Joseph Terry, NWAFC, Seattle; Samuel Pooley, SWFC, Honolulu; and Edward Ueber, SWFC, Tiburon attended the joint meeting of economists at the Tiburon Laboratory. Participants discussed the disposition of FY 1984 projects FY 1985 work, and planned research. The Northwest and Alaska Fisheries Center and the Southwest Region are coordinating joint-venture data access and status-of-the-fishery reports.

Trawl logbooks were also discussed and suggestions were made for determining which vessels fish off Alaska and the West Coast. Ueber will make a report to the PACFIN data committee in January about improvements in trawl logbook data collection and storage by California.

15 - William McFarland, Cornell University, Ithaca, New York, visited Edmund Hobson.

28 - Bruce Moorehead, NMFS, Washington, DC, visited Sus Kato.

MEETINGS AND TRAVEL

Honolulu Laboratory

December 2-8 - Dr. George W. Boehlert traveled to Monterey, California, to attend the GUTSHOP meeting, and to San Francisco, California to attend the American Geophysical Union/American Association of Limnology and Oceanography meeting.

3-5 - The monk seal recovery team meeting was held in the Honolulu Laboratory conference room.

4-7 - Dr. Robert A. Skillman attended the 47th Western Pacific Regional Fishery Management Council meeting at the Kauai Surf Resort.

6-8 - Laboratory Director Richard S. Shomura participated in the 4th Session of the Committee for the Development and Management of Fisheries in the South China Sea, Indo-Pacific Fishery Commission, at Kuala Lumpur.

10-15 - Richard Shomura attended the 21st Indo-Pacific Fishery Commission session at Kuala Lumpur.

19-20 - Richard Shomura participated in the Center Management Meeting in La Jolla, California.

La Jolla Laboratory

December 1-6 - Eric Lynn, Hannah Bernard, and Gail Theilacker traveled to Monterey, California, to attend GUTSHOP '84, the Fourth Annual Workshop on Fish Food Habits.

4 - David Hamm, Computer Systems Analyst at the Honolulu Laboratory, attended the fifth meeting of the Western Pacific Fishery Information Network (WPACFIN) Fisheries Data Coordinating Committee (FDCC). At the meeting representatives from American Samoa, Hawaii, Guam, Commonwealth of the Northern Mariana Islands, NMFS Southwest Fisheries Center and Region discussed confidentiality and data exchange and developed a basic understanding and agreement of the philosophy for WPACFIN data exchange. After completing a study of their fishery statistical system, the Hawaii Division of Aquatic Resources announced their decision to join the FDCC officially.

10-12 - Dan Huppert, Sam Herrick, and Dale Squires attended an economists meeting in Tiburon, California, with economists from the Center, the Region, and NWAFC.

11-13 - Jack Metoyer and William Flerx traveled to Seattle, Washington, to inspect modifications made to the R/V MacArthur and assess its suitability to complete Coastal Division CalCOFI cruises in FY 1985.

13 - Alec MacCall traveled to Long Beach, California, to attend a U.S. Fish and Wildlife Service workshop on the status of the California brown pelican.

17-21 - Steve Reilly traveled to Long Beach, California, to assist in aerial survey for pilot whales around Catalina Island.

Pacific Environmental Group

December 4-6 - Doug McLain, Jerry Norton and Dave Husby traveled to the AGU meeting in San Francisco, California. Norton presented a poster paper which he co-authored with Doug McLain entitled "Monitoring the California Current from Daily Sea Surface Temperature and Salinity Observations at Shore Stations."

McLain co-authored a paper with Craig Barilotti of Kelco Corporation and Roger Bauer of Compass Systems, Inc., entitled, "Forecasting Standing Crops of Macrocystis pyrifera from the depth of the 14° isotherm.

5-7 - Dick Parrish traveled to La Jolla, California, for an albacore task force meeting.

Tiburon Laboratory

December 3 - Pete Benville, Michael Bowers, Tony Chess, Mickey Eldridge, Ted Hobson, Dan Howard, and Bruce MacFarlane attended the 1984 GUTSHOP Conference at Asilomar, California.

13 - Fishery biologists Mickey Eldridge and Michael Bowers, chemist Pete Benville, and oceanographer Dr. R. Bruce MacFarlane met with researchers of the Pacific Environmental Group in Monterey, California, to discuss the best and most efficient ways to monitor environmental conditions in the habitats of sampled groundfishes. After this meeting, the Tiburon staff consulted with David Powell of the Monterey Aquarium on mutual research interests dealing with the collection, transport, and maintenance of different rockfish species.

18-19 - Norman Abramson attended the joint Southwest Center-Region and quarterly Center Management Meeting in La Jolla, California.

19 - Edward Ueber met with Sea Grant Advisor Constance Ryan in San Francisco, California, to discuss the upcoming gillnet study and the need for funding for a Vietnamese translator to administer the questionnaire (80% of the present gillnetters are Vietnamese, according to Ueber). Plans were made to meet with Paul Wild of the California Department of Fish and Game in Monterey, California, early in 1985. Wild is in charge of a biological study and has agreed to contribute his expertise and assistance in this multi-agency endeavor.

20 - Edward Ueber introduced Michael Bowers to local processors for the purpose of obtaining bocaccio, chilipepper, and widow and yellowtail rockfish for the groundfish research of the Physiological Ecology Investigation.

PERSONNEL

Honolulu Laboratory

December 5 - Thea C. Johanos, Wildlife Biologist - Resignation.

- Alan K.H. Kam, Biological Technician (Wildlife) - Resignation.

7 - Doris J. Alcorn, Wildlife Biologist - Resignation.

10 - Robin L. Westlake, Biological Technician (Wildlife) - Extension of Temporary Appointment.

14 - Joan P. Draper, Computer Programmer - Extension of Temporary Appointment.

- Julie J. Eliason, Biological Technician (Wildlife) - Termination.

- Robert J. Morrow, Biological Technician (Wildlife) - Termination.

- Richard N. Uchida, Supervisory Fishery Biologist (Research) - Voluntary Retirement.

23 - Samuel G. Pooley, Industry Economist - Conversion to Career Appointment.

- Theresa Villanueva, Biological Science Student Trainee (NOAA Jr. Fellow) - Return to Duty.

La Jolla Laboratory

December 4 - Clifford Ratcliffe, Clerk Typist - Entered on Duty.

21 - Brian Vorndam, Computer Assistant - Resignation.

28 - Gina Battiste, Biological Aid - Resignation.

31 - Carrie Wilson, Biological Technician - Entered on Duty.

Tiburon Laboratory

December 1 - John C. Greeley, Editorial Assistant - Extension of Temporary Appointment.

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